

REMARKS/ARGUMENTS

Claims 1-17, 26-42 and 51-52 were pending in the Office Action, and upon entry of the present paper, claims 27 and 28 are canceled without prejudice or disclaimer, while new claims 53-54 are added. In the Office Action, claims 3-5, 9-10, 12-13, 28-30, 34-35 and 37-38 are indicated as being directed to allowable subject matter, and Applicants thank the Examiner for this indication. As for the other claims, those are treated as follows:

- claims 1, 26 and 51-52 stand rejected under 35 U.S.C. 103(a) as being unpatentable over an alleged combination of Marzetta (U.S. Patent No. 6,307,882) and Rashid-Farrokhi et al. (U.S. Patent No. 6,400,780¹);
- claims 2, 6-7, 27 and 31-32 stand rejected under 35 U.S.C. 103(a) as being unpatentable over an alleged three-way combination of Marzetta, Rashid-Farrokih et al., and Ariv et al. (U.S. Patent No. 6,621,877);
- claims 8 and 33 stand rejected under 35 U.S.C. 103(a) as being unpatentable over an alleged three-way combination of Marzetta, Rashid-Farrokih et al., and Heiskala (U.S. Patent No. 6,298,035);
- claims 11 and 36 stand rejected under 35 U.S.C. 103(a) as being unpatentable over an alleged four-way combination of Marzetta, Rashid-Farrokih et al., Heiskala, and Canada et al. (U.S. Patent No. 6,546,236);

¹ The Office Action refers to this as Patent No. 6,400,789, but that designation appears to be in error. Applicants understand that 6,400,780 was the intended number, but if Applicants are mistaken, and the Office Action intended a different number, Applicants respectfully request clarification of the number and an opportunity to respond to the referenced patent.

- claims 14 and 39 stand rejected under 35 U.S.C. 103(a) as being unpatentable over an alleged three-way combination of Marzetta, Rashid-Farrokih et al., and Parkvall et al. (U.S. Patent No. 6,542,736);
- claims 15 and 40 stand rejected under 35 U.S.C. 103(a) as being unpatentable over an alleged three-way combination of Marzetta, Rashid-Farrokih et al. and Kroeger et al. (U.S. Patent No. 6,549,544); and
- claims 16-17 and 41-42 stand rejected under 35 U.S.C. 103(a) as being unpatentable over an alleged three-way combination of Marzetta, Rashid-Farrokih et al. and Canada.

Applicants respectfully traverse these rejections with the discussion below.

Availability of Heiskala

As an initial matter, Applicants note that the Office Action relies on Heiskala to reject claims 8, 11, 33 and 36 under 35 U.S.C. 103(a). Heiskala was filed before the present application was filed, but was neither published nor issued before the present application was filed, and therefore qualifies as prior art only under 35 U.S.C. 102(e). However, pursuant to 35 U.S.C. 103(c), this reference is unavailable for a 103 rejection. Both Heiskala and the present application have the same assignee (Nokia Networks Oy), and Applicants submit the present application and the Heiskala application were, at the time the invention herein was made, owned by, or subject to an obligation of assignment to, the same entity (Nokia Networks Oy). This patent is unavailable for a rejection of the present application under 35 U.S.C. 103, and Applicants respectfully request reconsideration and withdrawal of the rejections that rely on Heiskala.

Independent Claim 26, and Dependent Claims 27-42

Applicants again wish to thank the Examiner for the indication that dependent claim 28 (among other claims) is being allowable if rewritten in independent form. To expedite prosecution, Applicants have amended independent claim 26 to recite language previously found in dependent claim 28 and intervening dependent claim 27, and Applicants submit that claim 26 is in condition for allowance. Applicants note that in making this amendment, Applicants revised the “rounding and truncating” language to recite “shortening,” and that this change does not affect the allowability of the claim. Claims 29-42 depend from claim 26, and are allowable for at least the same reasons as claim 26, and further in view of the various features recited therein.

Independent Claim 1, and Dependent Claims 2-17 and 51-52

Independent claim 1 recites the following steps:

- receiving at least two space-time coded signals from an antenna system associated with a first station;
- determining complex channel state information based on the received space-time coded signals; and
- sending the complex channel state information to the first station.

The Office Action primarily relies on Marzetta to reject claim 1. Marzetta relates to a particular problem encountered with the so-called Foschini communication system. In the Foschini system as explained by Marzetta, a receiver uses “nulling” and “cancellation” techniques with the propagation characteristics of a medium between the receiver and a transmitter to discriminate between the various signals sent by the transmitter. Marzetta, col. 1, lines 55-65. Marzetta notes, however, that although Foschini’s receiver uses these propagation

characteristics, Foschini apparently does not provide details on how the receiver is supposed to get those characteristics in the first place. Marzetta, col. 1, lines 62-65. Marzetta offers his solution, which involves a transmitter sending a predetermined set of training signals so that the receiver can calculate the intervening propagation characteristics. Specifically, the Marzetta system uses a “training” stage in which the transmitter 12 sends a predetermined set of training signals to the receiver 18. Both transmitter and receiver know, in advance, the set of training signals being used. See, e.g., Marzetta, col. 3, lines 63-66. When the receiver receives the transmitted signals in the training mode, it compares the received signals with the actual training signals, and from this comparison it determines the various components of a channel propagation matrix H for transmissions between the transmitter and receiver antennas. See, e.g., Marzetta, col. 3, lines 9-13. Once the receiver is “trained”, and has the matrix H , the receiver can then enter a second stage of operation, where it uses the matrix to differentiate the individual signals sent by the transmitter in future transmissions. See, e.g., Marzetta, col. 6, lines 29-33. Marzetta’s receiver does not transmit the propagation characteristics H back to the transmitter, and Marzetta offers no suggestion that its transmitter would even have any use for this matrix.

In relying on Marzetta, the Office Action alleges that the Marzetta training signals are the claimed “space-time coded signals from an antenna system associated with a first station,” and that the propagation matrix H is the claimed “complex channel state information.” Office Action, p. 2. The Office Action concedes, however, that Marzetta fails to teach or suggest the claimed step of “sending the complex channel state information to the first station.” Applicants agree – as noted above, Marzetta’s transmitter has no use for the propagation matrix H , and this matrix is not sent to the Marzetta transmitter (alleged to be the claimed “first station”).

The Office Action alleges, however, that it would have been obvious to one of ordinary skill to modify Marzetta such that the propagation matrix H was sent from the receiver back to the transmitter. The Office Action cites Rashid-Farrokhi et al. to justify this modification. Rashid-Farrokhi et al. relates to wireless communication systems in which multiple terminals communicate with a given base station, and where interference among these various signals creates a problem. Rashid-Farrokhi et al. seeks to alleviate this problem and reduce the signal to interference and noise ratio (SINR) by having all wireless terminals send “channel information” to their base station, and having the base station use this information in specific equations to adjust weighting values for each of the wireless terminals. Rashid-Farrokhi et al., col. 5, lines 46-56 and col. 7, lines 19-38.

The Office Action assumes that, if the two were combined, the resulting system would use the Marzetta propagation matrix H as the Rashid-Farrokhi et al. “channel information.” There is no support for such an assumption. To the contrary, the Marzetta propagation matrix H does not appear to even be compatible with the Rashid-Farrokhi et al. calculations. Marzetta shows that its propagation matrix H identifies a separate characteristic coefficient for each pair of antennas between the set of transmit antenna elements (1-m) from a single transmitter and the set of receiving antenna elements (1-n) for the single receiver. Marzetta, col. 3, line 41 to col. 4, line 38. The Rashid-Farrokhi et al. “channel information,” however, does not include such data. Instead, the Rashid-Farrokhi et al. “channel information” is a single “channel response” function allotted for each terminal. See Rashid-Farrokhi et al., col. 6, lines 12-43. There is no teaching or suggestion of how the Rashid-Farrokhi et al. equations could even use the Marzetta multi-antenna element matrix propagation matrix H , and if such a combination were made, the more likely result would involve the receiver sending the actual channel information used in Rashid-

Farrokhi et al., and not the propagation matrix H of Marzetta. The alleged combination, even if proper, would not result in the claimed method, with its step of “sending the complex channel state information to the first station.”

Additionally, there is no proper motivation for the alleged combination. Rashid-Farrokhi et al. does not relate to the Foschini system (the focus of Marzetta), and there is no explanation in Marzetta or Rashid-Farrokhi et al. as to how the Marzetta propagation matrix H would even be of any use to the transmitter.

Claims 2-17 and 51-52 depend from claim 1, and are allowable for at least the same reasons as claim 1, and further in view of the various features recited therein. For example, claim 15 recites “The method of claim 1, wherein the complex channel state information includes at least one weight, each weight including amplitude and phase angle information.” The Office Action concedes that Marzetta and Rashid-Farrokhi et al. fail to teach or suggest this recited feature, but alleges that a three-way combination with Kroeger et al. overcomes this deficiency. Office Action, pp. 7-8. Kroeger et al. relates to one-way digital broadcast of FM and AM radio signals, such as the broadcast of music commonly heard through car radios. Neither Marzetta nor Rashid-Farrokhi et al. deals with such systems, and Kroeger et al. similarly does not deal with two-way cellular communication systems, or the Foschini system used in Marzetta. There is no objective reason why one of ordinary skill would seek to make this peculiar three-way combination.

CONCLUSION

All rejections having been addressed, Applicants respectfully submit that the instant application is in condition for allowance, and respectfully solicit prompt notification of the same.